

## REQUEST FOR A PSD PERMIT MODIFICATION

Prepared For  
**KNAUF FIBER GLASS**  
Shasta Lake, California

August 8, 2003



**Mostardi Platt**  
*Environmental*

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MPE PROJECT M030601



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**Knauf Fiber Glass - Shasta Lake, California**

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### **1.0 INTRODUCTION**

Knauf Fiber Glass GmbH (Knauf) operates a 195-ton per day fiberglass manufacturing facility in Shasta County, California. A site location map can be found in Figure 1.0-1. Shasta County is located at the northern end of the Sacramento Valley Air Basin.

The plant site is a 92-acre parcel in Shasta Lake. The facility address is:

Knauf Fiber Glass  
3100 District Drive  
Shasta Lake, California 96019

The UTM coordinates (NAD 27, Zone 10) at the center of the facility are:

Northing	4,500,750	meters
Easting	551,620	meters

The Latitude and Longitude at the center of the facility are:

Latitude	40°	39'	30"
Longitude	122°	23'	23"

### **1.1 Project Contact**

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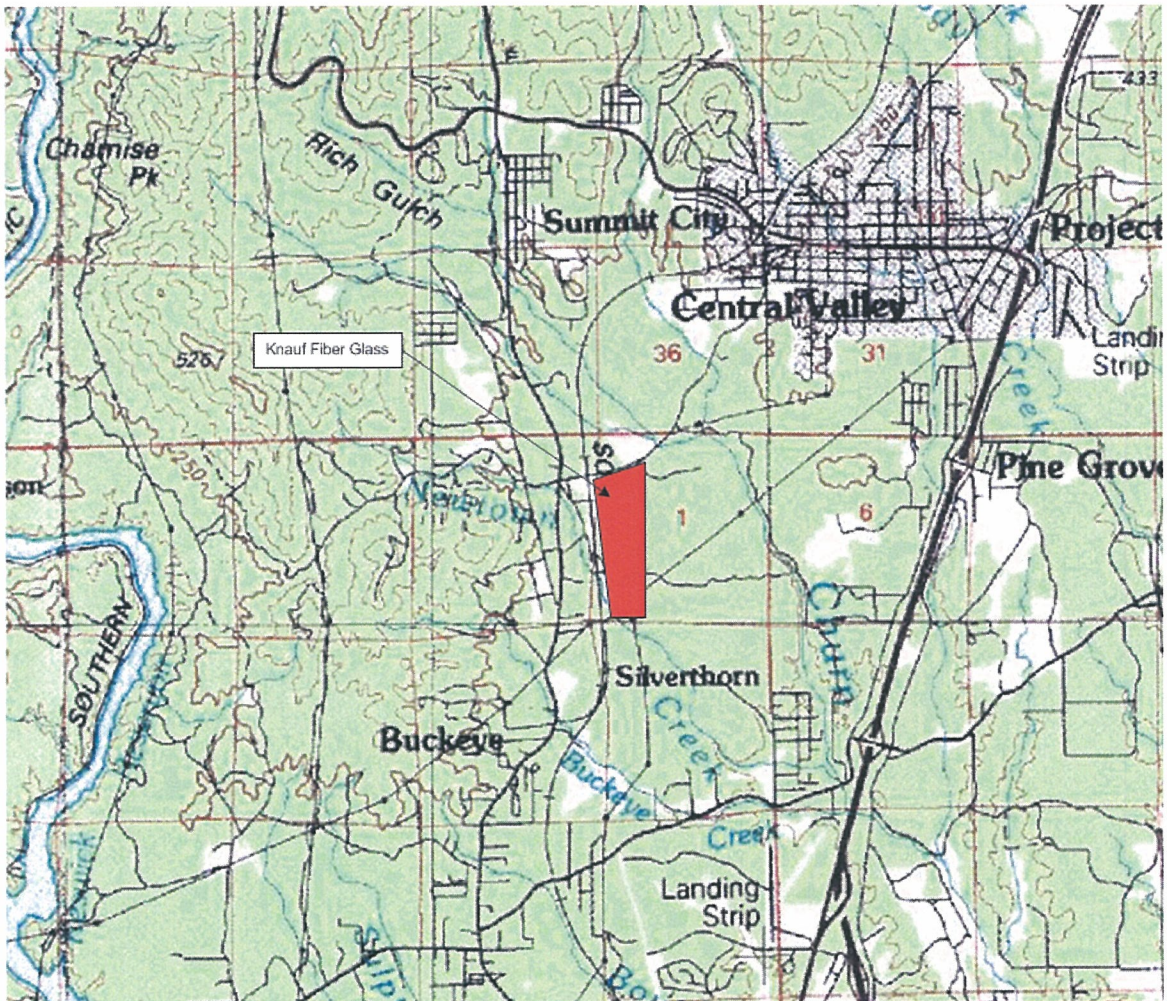


Figure 1.0-1. Site Location Map



### 1.3 Permit History

Knauf submitted an air quality permit application under the federal Prevention of Significant Deterioration (PSD) requirements on July 17, 1997. A PSD permit application was completed for PM<sub>10</sub> because there was potential for the particulate emission rates to exceed 100 tons per year (TPY) and thus trigger PSD review for PM<sub>10</sub>. Using the conservative estimates, PM<sub>10</sub> emissions were estimated at 191.8 TPY (43.6 lb/hr), and the PSD threshold is 100 TPY. All other air pollutant emissions were considered minor in comparison to the PSD thresholds as shown in Table 1.3-1. All analyses for PM<sub>10</sub> for the original PSD application were based on 191.8 TPY.

**Table 1.3-1. Knauf Shasta Facility Emissions from Original PSD Application.**

Pollutant	Knauf Plant, TPY	PSD Review Required?
PM <sub>10</sub>	191.8 (124.4) <sup>a</sup>	Yes
NO <sub>x</sub>	24.8	No
SO <sub>2</sub>	4.4	No
CO	97.7	No
ROG (includes Formaldehyde and Phenol)	39.4	No
Formaldehyde	8.76	No
Phenol	26.28	No
Ammonia	166.4	No

Note: Knauf Fiber Glass considers all particulate matter as PM<sub>10</sub>. Since PM<sub>10</sub> emissions have more stringent limitations, all discussions in this permit application utilize PM<sub>10</sub> rather than PM.

<sup>a</sup> PSD permit issued had a reduced PM<sub>10</sub> limit.

After an extensive period of appeals, the PSD permit was issued three years later on March 22, 2000 with a reduced PM<sub>10</sub> emission limit of 124.4 TPY (28.4 lb/hr). Construction of the facility commenced immediately and the plant began operation on February 4, 2002. Air emissions testing was completed in April and December 2002.

Based on oven exhaust gas and thermal oxidizer burner manufacturer's emission estimates, nitrogen oxides (NO<sub>x</sub>) emissions from the facility were expected to be minor due to the use of low NO<sub>x</sub> burners in the fiberglass curing oven and thermal oxidizers. As a result, NO<sub>x</sub> was not formally evaluated under PSD in the original PSD permit application, but was evaluated in the California Environmental Quality Act (CEQA) Environmental Impact Report (EIR) and the required California Best Available Control Technology (BACT) analysis.

The results of the air emissions testing program demonstrated that the PM<sub>10</sub> emission rate was equivalent to a level below 100 TPY. NO<sub>x</sub> emissions test results demonstrated that the actual emissions resulted in a level that exceeded 40 TPY, but were less than 100 TPY.

## **1.4 Application for a Permit Modification**

This permit application contains the necessary information for the U.S. Environmental Protection Agency (EPA or Agency), Region IX, to review the proposed permit modifications and perform the following actions:

1. Authorize a decrease in total plant PM<sub>10</sub> emissions from 124.4 TPY to 100 TPY.
2. Authorize an increase in facility NO<sub>x</sub> emissions from 24.8 TPY to 99 TPY.
3. Authorize an increase in PM<sub>10</sub> emissions from the electric glass melting furnace to 1.0 pound per hour (increased from 0.1 to 1.0 lb/hr) which has been offset by lowering the manufacturing line PM<sub>10</sub> emission rate.



## 2.0 PROJECT DESIGN

### 2.1 Process Description

The Knauf Shasta facility consists of one fiber glass insulation production line rated at 195 tons of molten glass per 24-hour production day. A process flow diagram is included as Figure 2.1-1, and the typical material handling flow diagram is included as Figure 2.1-2. Fiber glass manufacturing consists of the following processes:

1. Raw materials handling
2. Molten glass preparation
3. Fiber forming and binder application
4. Curing the binder-coated fiber glass mat
5. Cooling the mat
6. Facing
7. Cutting and packaging

#### 2.1.1 Raw Materials Handling

The primary component of fiberized glass is silica sand, but it also includes granular quantities of soda ash, limestone, borax, dolomite, feldspar and other minor ingredients. The raw materials are received in bulk by rail car and truck. The bulk raw materials are unloaded from the trucks and rail cars by a mechanical conveying system to storage silos. All conveying and storage areas are enclosed.

From the storage areas, the materials are measured by weight according to the desired product recipe and blended prior to their introduction into the electrical glass melting furnace. The weighing, mixing and charging operations are conducted in batch mode.

Particulate matter (PM) is the only regulated pollutant that is generated by the raw materials handling operation. Emissions from the indoor dust collectors are insignificant and vent indoors. There is no ultimate vent point that leads to the atmosphere outside the building. Air is exhausted from these dust collectors only when batch raw materials or mixed batch is transported through the system. Proposed methods for controlling particulate matter from conveying and storage operations include enclosures and fabric filter dust collectors. All captured particulates are recycled back to the system.

The furnace batch day bins, containing mixed batch ready to be put into the furnace, are located next to the furnace and exhaust into the furnace/forming building. Negative pressure inside of this building prevents any emissions from these devices from exiting the building. Due to the extremely large volume of air exhausted through the forming section, a negative pressure is generated throughout the entire building. All fugitive emissions from the inside-vented dust collectors, raw material storage tanks, washwater storage, etc. pass through the forming section control devices prior to being discharged through the main stack. Any emissions from these sources are measured during emission tests on the main stack. To control fugitive emissions, all

emissions from the mixing process and indoor venting are routed through the forming operation (via induced draft) and are included in the overall emission rates for the process.

### **2.1.2 Molten Glass Production**

After introduction into the electric glass melting furnace, the raw materials are heated to a temperature of approximately 2,500 °F and transformed through a sequence of chemical reactions to molten glass. The proportions of the glass ingredients remain the same for the various products manufactured on the line. The raw materials are introduced continuously at the rear of the furnace where they are slowly mixed and dissolved.

Since all glass melting is done electrically (no fuel combustion), the only pollutant emitted by the glass melting furnace is particulate matter in trace amounts from the batch feeding process. The particulate emissions are controlled by two fabric filter baghouse dust collectors with 99+% removal efficiency.

### **2.1.3 Glass Fiber Forming and Binder Application**

The rotary spin process is used in the Knauf facility production line to form glass fibers. In the rotary spin process, molten glass from the furnace is continuously poured into a rotating cylinder or spinner. Centrifugal force causes the molten glass to flow through small holes in the wall of the spinner. The emerging fibers are entrained in a high velocity air stream, and binder is applied to bond the fibers. Typically, the binder consists of a solution of phenol-formaldehyde resin, water, urea, organo silane, ammonium sulfate and ammonia.

The liquid phenol-formaldehyde resin is purchased and stored as a 50-55% solid concentration (45-50% water) and mixed with the other ingredients as needed. The resin dilution operation is a batch process. In the batch process the resin is diluted with water and other ingredients in vented mixing tanks and then stored for use. All emissions from the mixing and indoor venting are routed through the forming operation (via induced draft) and included in the overall emission rates for the forming operation.

The glass fibers are pulled onto a perforated flyte conveyer belt directly below the spinners by suction air from fans pulling air through the perforated conveyer belt. The fibers are collected on the conveyer to form a fiberglass mat. Each spinner contributes fiberized glass to the mat causing the mat to increase in thickness as it travels through the forming section. The thickness of the uncured fiber glass mat is controlled by the conveyer speed.

The quantity of binder solids sprayed onto the glass fibers is governed by the type of product being manufactured. Residential insulation is approximately 4% binder by weight, whereas metal building, duct wrap and flexible duct material are up to 10% binder by weight. Typically, about 85% of the binder applied to the fiber glass remains on the product (referred to as binder application efficiency); the remainder is exhausted with the forming or curing oven air to an air pollution control device, or remains on the conveyer.



Figure 2.1-1. Process Flow Diagram for Knauf Fiber Glass.

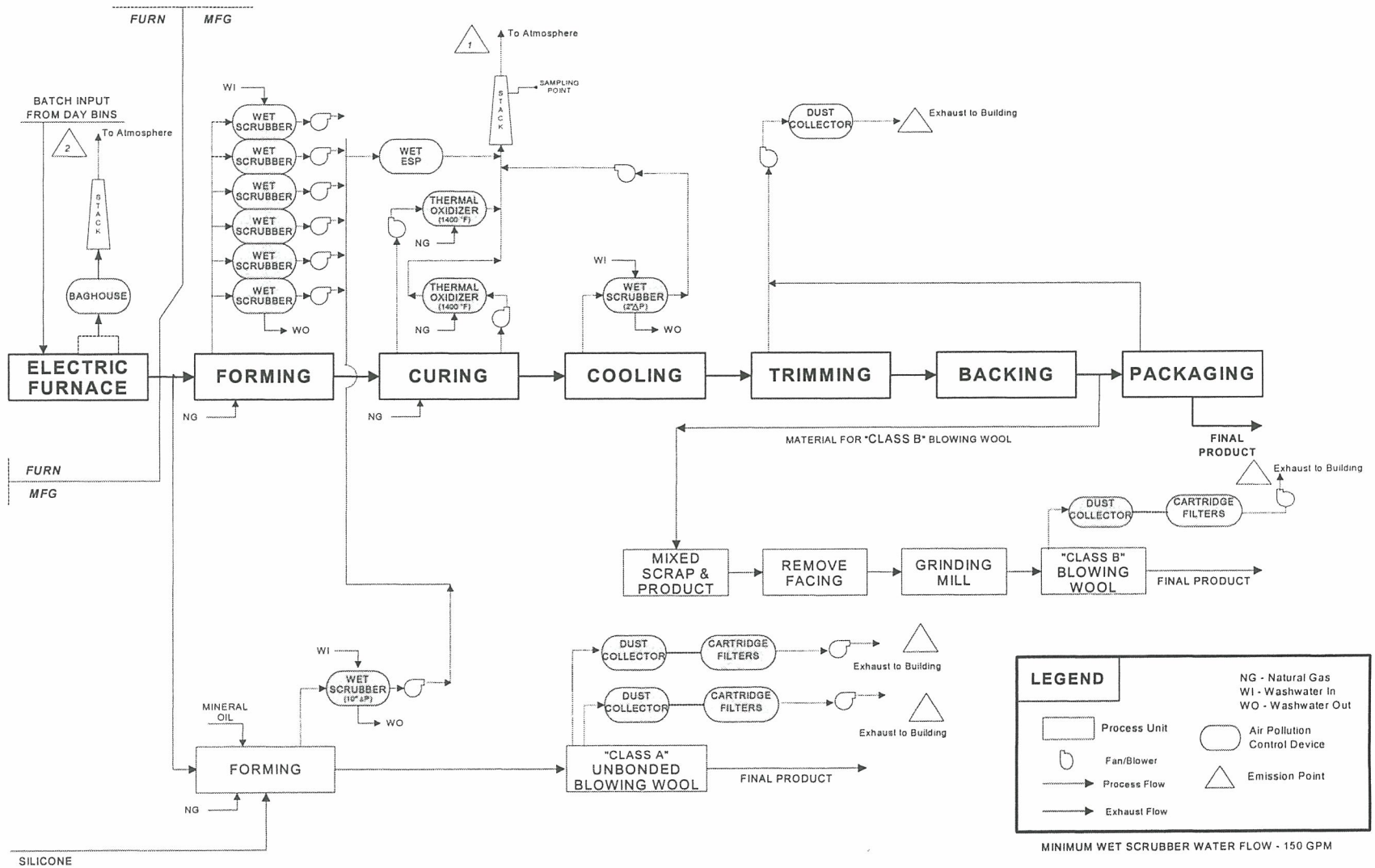
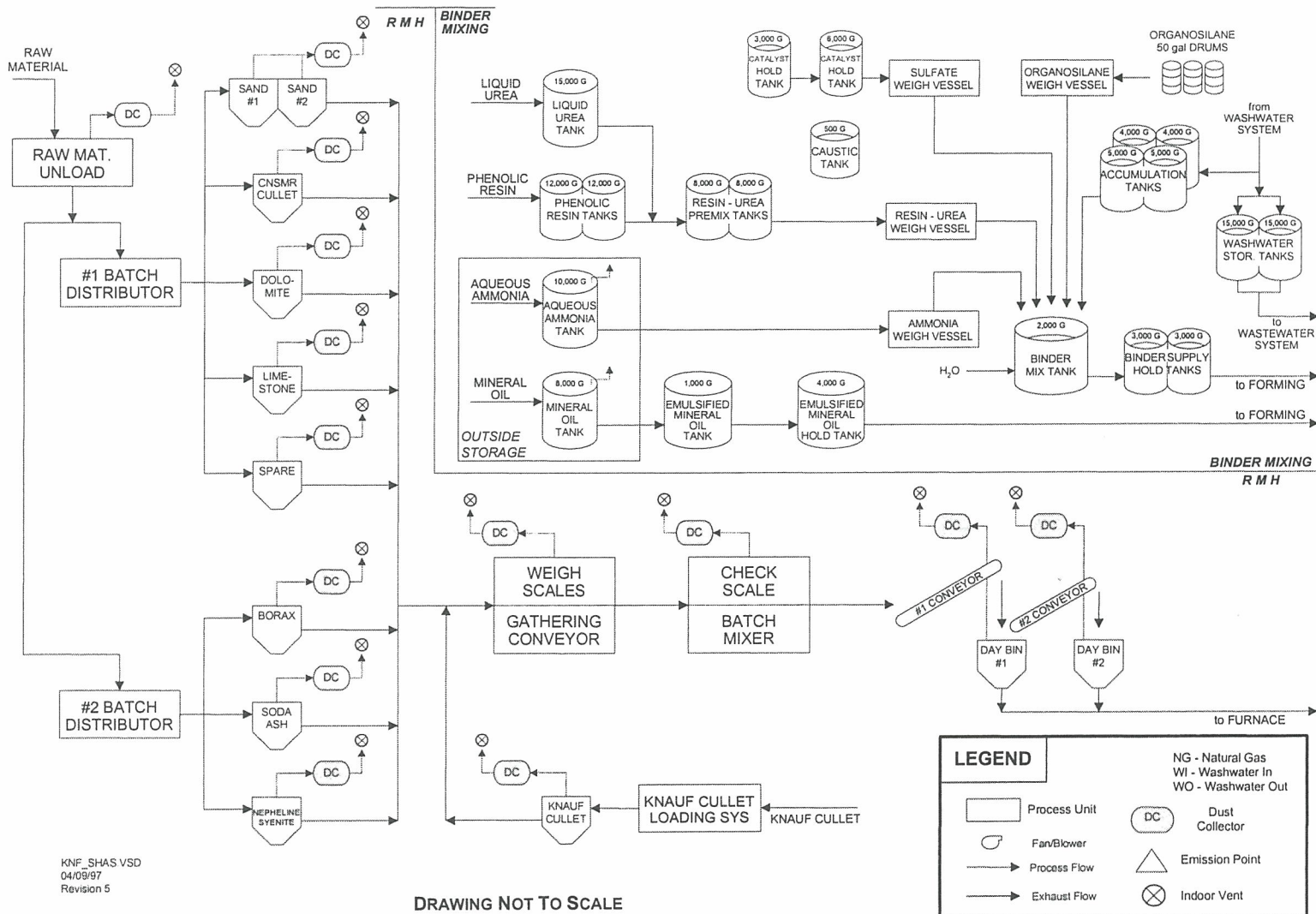


Figure 2.1-2. Typical Material Handling Flow Diagram.





Quality control checks will be routinely performed by plant personnel to determine the loss on ignition (LOI) of the product. The LOI check insures that the correct weight percent of binder is present in the product. To determine the LOI, a sample of the product is weighed, ignited to remove the binder and reweighed.

The fiber glass from several of the rotary spinners is diverted without binder application to a processing area to be packaged as unbonded blowing wool insulation.

The regulated pollutants which are emitted from the forming and binder application section are reactive organic gases (ROGs)/volatile organic compounds (VOCs) and PM, 90% to 95% of which are organic solids and the balance of which are inorganic solids and minute amounts of entrained glass fibers. Carbon monoxide (CO), NO<sub>x</sub>, and trace amounts of sulfur dioxide (SO<sub>2</sub>) are also emitted from the combustion of natural gas. The exhaust stream from the forming sections is sent through wet venturi scrubbers and a wet electrostatic precipitator prior to entering the stack.

#### **2.1.4 Curing the Binder-Coated Fiber Glass Mat**

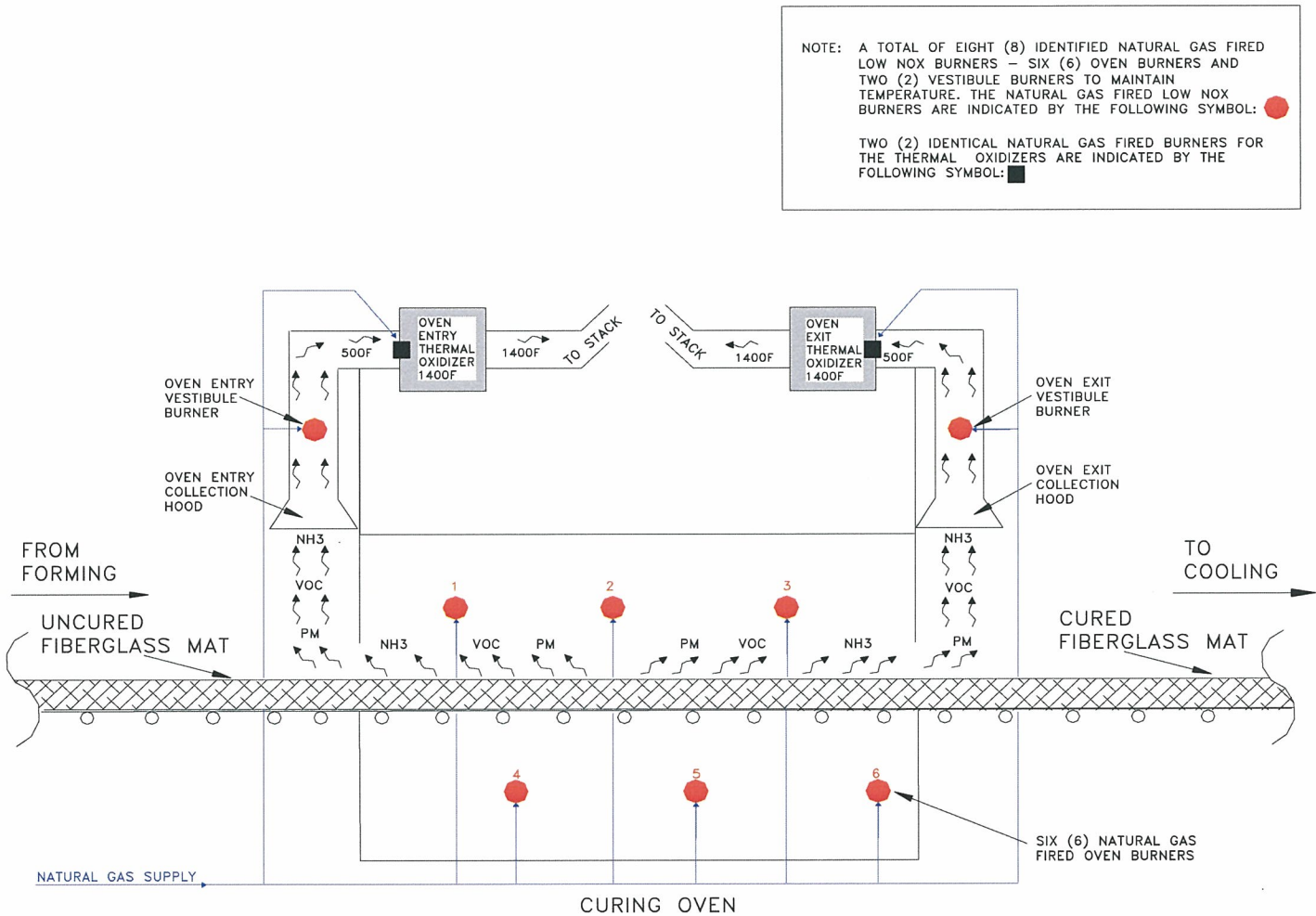
After the mat is formed, it continues on the conveyer to the curing oven. Upper and lower perforated flytes in the oven compress and cure the fiber glass mat to the desired final thickness. The clearance between the flytes may be adjusted for different products.

The purpose of the curing oven is to drive off the moisture remaining on the fibers and cure the binder. The oven has six (6) zones, plus two (2) vestibule burners to maintain temperature. Each zone has its own low NO<sub>x</sub> burner and blower to recirculate the hot air through the mat. An illustration of the curing oven is shown in Figure 2.1-3. The oven burners are Maxon Model 3.7M low NO<sub>x</sub> burners. Each of the eight oven burners is rated at 3.7 million Btu per hr (MMBtu/hr; High Heating Value basis), with a NO<sub>x</sub> emission rate of 0.034 lb/MMBtu. The normal operating rate per burner is 40% of capacity, or 1.5 MMBtu/hr.

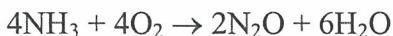
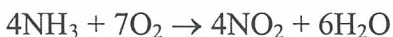
The oven temperature ranges from 450 °F to 500 °F. Hoods are at the entry and exit of the oven to capture the exhaust from the oven.

The regulated pollutants emitted from the curing oven are particulate matter and reactive organic gasses from heating the binder, and NO<sub>x</sub>, SO<sub>2</sub>, and CO from the natural gas combustion burners. These pollutants are sent through two (2) thermal oxidizers prior to entering the main stack as shown in Figure 2.1-3. A thermal oxidizer is the best available control device for the destruction of VOCs contained in the binder. The thermal oxidizers are Maxon Kinedizer Model 18M rated at 18 million Btu/hr. The normal operating level is between 60 and 70%, or 10.8 to 12.6 million Btu/hr. Typical destruction efficiencies exceed 90% at a thermal oxidizer outlet temperature of 1400 °F.

Figure 2.1-3. Curing Oven with Thermal Oxidizers.



As stated in Section 2.1-3, the binder contains ammonia and urea. Some free ammonia is present and enters the curing oven. In addition, during the curing process, ammonia is one of the byproducts that are driven off during the thermal decomposition of urea. As this ammonia passes through the thermal oxidizers operating with a minimum outlet temperature of approximately 1400 °F, some of the free ammonia is converted to additional NO<sub>x</sub> as follows:



The magnitude of the NO<sub>x</sub> created by the ammonia oxidation was not known at the time the original PSD permit application was filed for this facility.

### **2.1.5 Cooling the Mat**

After the mat has been cured, it passes over a cooling section where ambient room air is induced through the mat. The regulated pollutants emitted from the cooling section are minor amounts of PM and ROG. The exhaust from the cooling section exits through the common stack.

### **2.1.6 Facing**

An asphalt adhesive precoated paper facing is heated and pressed against the cooled mat for some of the insulation products. A water-based adhesive is also used to glue facings to some products.

### **2.1.7 Cutting and Packaging**

Just prior to the facing section of the line, the mat edges are trimmed and cut. The trimmed edge waste is recycled using an air conveyer system back to the forming section to be included with the mat being formed.

The dust that develops during the cutting and packaging operations is collected with an air evacuation system and filtered with a fabric filter dust collector system.

Blowing wool is sent through a separation system that removes the wool from the blown air stream and packages it.

## **2.2 Operating Schedule**

This permit application is for continuous operation of the Knauf Shasta facility (8760 hours/year).



## 2.3 Plant Emissions

Authority to Construct and New Source Review (NSR) regulations require a determination of the source's potential to emit (PTE), which is the maximum capacity of a stationary source to emit air pollutants under its physical limitations and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, provided the limitation is enforceable, is to be treated as part of its design. The emission rates presented in this section are based on maximum plant operations.

### 2.3.1 Air Pollutants

The following PTE emission rates are based on 195 tons of molten glass being produced per day (8.13 tons/hr). The major source of air pollutants at the facility comes from the combined stack for the forming, oven, and cooling operations. The PTE emission rates for all pollutants from the combined forming, oven, and cooling are listed in Table 2.3-1.

The basis for the PTE rates are the currently permitted limits at 8,760 hours of operation, with the exception of PM<sub>10</sub> and NO<sub>x</sub>, which are the values listed in this application. Emission calculations can be found in Appendix A for PM<sub>10</sub> and NO<sub>x</sub>.

**Table 2.3-1. Manufacturing Line (Forming, Oven and Cooling) Stack PTE Emissions.**

Pollutant	lb/hr	tons/yr (TPY)
PM <sub>10</sub> (particulate matter less than 10 microns in size)	21.9*	95.6
NO <sub>x</sub>	22.6*	99.0
SO <sub>2</sub>	1.0	4.4
CO	22.3	97.7
ROG (includes Formaldehyde and Phenol)	9.0	39.4
Formaldehyde	2.0	8.8
Phenol	6.0	26.3
Ammonia	38.0	166.4

\* Change from original PSD application.

PM<sub>10</sub> emissions also exhaust from a dust collector associated with the electric glass melting furnace. The total plant PTE emission rates are given in Table 2.3-2.

**Table 2.3-2. Total Plant PM<sub>10</sub> Emissions.**

<b>Emission Source</b>	<b>lb/hr</b>	<b>TPY</b>
Combined Forming/Oven/ Cooling Stack	21.9	95.6
Electric Glass Melting Furnace Dust Collector	1.0	4.38
<b>Total PM<sub>10</sub> Emissions</b>	<b>22.9</b>	<b>100.0</b>

### 3.0 APPLICABLE REGULATORY REQUIREMENTS

This section discusses the applicable regulatory requirements for submitting a PSD Permit Modification for the Knauf facility in Shasta Lake, California.

#### 3.1 New Source Review (NSR)

The Clean Air Act (Act) requires that new major stationary sources of air pollution, or major modifications of existing sources, obtain air pollution permits and/or approvals prior to commencing construction. Sources located in attainment areas (areas where all National Ambient Air Quality Standards (NAAQS) have been met) are required to perform NSR for compliance with NAAQS and PSD requirements. These preconstruction review programs for the Knauf Shasta facility were originally processed by the Shasta County Air Quality Management District. On March 3, 2003, this delegation was removed and the issuance of PSD permits for Shasta County is now performed by EPA Region IX.

PSD regulations are promulgated in federal regulations under Title 40, *Code of Federal Regulations*, Part 52.21 (40 CFR 52.21). The PSD program is designed to ensure that air quality will not significantly deteriorate in areas where the NAAQS are being met. The PSD regulations specify that any major new stationary source or major modification to an existing major source within a NAAQS attainment area must undergo a PSD review and obtain all applicable federal and state preconstruction permits prior to commencement of construction.

##### 3.1.1 PSD Applicability

A stationary source, whether a proposed new source or an existing source, is considered major if it is:

- One of the 28 named source categories listed in Section 169 of the Act and emits, or has a PTE of 100 TPY or more of any air pollutant regulated by the Act or,
- Is an unlisted stationary source that emits or has the PTE of 250 TPY or more of any air pollutant regulated by the Act.

Glass fiber processing plants are one of the 28-named PSD source categories. The Knauf Shasta facility is subject to the 100 TPY PSD threshold. Once the PSD applicability threshold is exceeded for any pollutant, the regulated individual air pollutant emissions are compared to the significant emission levels listed in Table 3.1-1. If the air pollutant exceeds the significant emission level, then a PSD review applies to that pollutant.



**Table 3.1-1. Significant Pollutant Emission Rates Once PSD Has Been Triggered.**

<b>Pollutant</b>	<b>Emission Rate (TPY)</b>
Carbon monoxide	100.0
Nitrogen oxides	40.0
PM (total suspended particulates)	25.0
PM <sub>10</sub>	15.0
Sulfur dioxide	40.0
Ozone, as Volatile Organic Compounds (VOC), also Reactive Organic Gases (ROG) in Shasta County	40.0
Lead	0.6
Mercury	0.1
Beryllium	0.0004
Asbestos	0.007
Fluorides	3.0
Sulfuric acid mist	7.0
Vinyl chloride	1.0
Hydrogen sulfide	10.0
Total reduced sulfur (including H <sub>2</sub> S)	10.0
Reduced sulfur compounds (including H <sub>2</sub> S)	10.0
Benzene	0
Inorganic arsenic	0
Radionuclides	0

Note: All PM is considered to be PM<sub>10</sub>.

A comparison of the PTE emission rates for the Knauf facility, in contrast to the PSD significant emission thresholds, is given in Table 3.1-2.

**Table 3.1-2. Knauf Shasta Facility Annual Emissions.**

<b>Pollutant</b>	<b>Knauf Plant, TPY</b>	<b>PSD Threshold If Any One Criteria Air Pollutant Equals or Exceeds 100 TPY</b>	<b>PSD Applicability for This Permit Modification</b>
PM <sub>10</sub>	100.0	15.0	No
NO <sub>x</sub>	99.0	40.0	Yes
SO <sub>2</sub>	4.4	40.0	No
CO	97.7	100.0	No
ROG (includes Formaldehyde and Phenol)	39.4	40.0	No
Formaldehyde	2.0	N/A	No
Phenol	6.0	N/A	No
Ammonia	38.0	N/A	No

Note: All PM is considered to be PM<sub>10</sub>.

### **3.1.2 PSD Requirements**

If a PSD review is triggered, the PSD regulations require the following analyses to be performed for the facility for each pollutant that exceeds the significant emission rates:

1. A BACT analysis to determine which control strategy and equipment is most appropriate for the plant being constructed.
2. An air quality impacts analysis to demonstrate that each significant emission increase resulting from the proposed emissions will not cause or contribute to a violation of any allowable increment or NAAQS.
3. An additional impacts analysis to determine the effects of the emission increase on soils, vegetation, visibility, and each potentially affected Class I area and the surrounding areas as a result of induced growth.

### **3.1.3 Air Quality Standards**

For areas that are in attainment with the NAAQS, maximum allowable increases or “increments” in ambient pollution concentrations have been established for PM<sub>10</sub>, NO<sub>x</sub>, and SO<sub>2</sub>. These PSD increments are presented in Table 3.1-3, along with the CARBAQS, Significant Impact Levels (for modeling purposes), and 8-hour Personal Exposure Limits (PEL). The PSD increments are

an absolute ceiling, stated as the maximum allowable increases in concentration of the pollutant over a baseline concentration. In effect, the PSD increments, when added to baseline concentrations represent new ambient air quality levels for PSD areas.

**Table 3.1-3. Air Quality Standards.**

<b>Pollutant</b>	<b>Averaging Period</b>	<b>NAAQS (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>CARBAQS (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>PSD Increment (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Significant Impact Levels (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>PEL (<math>\mu\text{g}/\text{m}^3</math>)</b>
Ozone	1-Hour	235	175	-	-	-
PM <sub>10</sub>	Annual	50	30	17	1	-
	24-Hour	150	50	30	5	-
NO <sub>x</sub>	Annual	100	-	25	1	-
	1-Hour	-	500	-	-	-
SO <sub>2</sub>	Annual	80	-	20	1	-
	24-Hour	365	105	91	5	-
	3-Hour	1,300	-	512	25	-
	1-Hour	-	655	-	-	-
CO	8-Hour	10,000	10,000	-	500	-
	1-Hour	40,000	23,000	-	2000	-
Formaldehyde	8-Hour	-	-	-	-	2,000
Phenol	8-Hour	-	-	-	-	19,000
Ammonia	8-Hour	-	-	-	-	18,000

### 3.2 New Source Performance Standards

New Source Performance Standards (NSPS) are nationally uniform emission standards established by the EPA and set forth in 40 CFR 60. NSPS apply to every qualifying new source and are based on pollution control technology available to the category of source. Federal NSPS provide a starting point to evaluate required controls; however, the BACT analysis specifies the type of control technology required.

The Knauf facility is required to comply with the NSPS for glass fiber manufacturing. Since the electric glass melting furnace is exempt from the NSPS in 40 CFR 60, Subpart CC (no fuel combustion), only 40 CFR 60, Subpart PPP is applicable.



40 CFR 60, Subpart PPP sets an emission limit on rotary spin wool fiber glass insulation manufacturing lines of 5.5 kg per Mg of glass pulled (11 lb/ton). The term “manufacturing line” is defined by Subpart PPP to include the forming, curing, and cooling sections of the process.

### 3.3 Best Available Control Technology (BACT)

The PSD process requires an evaluation of emission control devices and techniques demonstrating that BACT will be applied to the source. The BACT evaluation ensures that technically feasible control technologies are evaluated and that air pollutant emissions are mitigated while limiting the impacts on available energy, the economy, and the environment within an affected area. This analysis ultimately determines the allowable emissions from a source and is the basis for demonstrating emission rates, ambient air impacts, and compliance with applicable regulations. The application of BACT must result in emissions which comply with the federal, state and local ambient impact standards. BACT is defined in 40 CFR 52.21 as:

“...an emissions limitation based on the maximum degree of reduction, which the Agency, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source through application of production process and available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each pollutant.”

A full BACT analysis ranks all feasible and available control technologies in descending order of control effectiveness. The most stringent or “top” alternative for comparable facilities is examined first. This alternative is established as BACT unless the applicant demonstrates that due to other considerations such as technical, energy, environmental, or economic reasons, it can be justified that a less stringent control technology is appropriate. If the most stringent technology is eliminated, then the process is repeated for the next most stringent alternative and so on.

To comply with the PSD requirements for BACT, the Knauf facility demonstrated BACT for PM<sub>10</sub> emissions in the original application in 1997. This permit modification evaluates BACT for NO<sub>x</sub> due to the increase from 24.8 to 99 TPY.

In addition to satisfying BACT in the PSD requirements, the Knauf facility must also satisfy BACT as defined in Section 205 of Shasta County Air Quality Management District Rules and Regulations. In Section 205, BACT is defined as the most stringent of one of the following:

- The most effective emission control device, emission limit, or technique that has been required or used for the type of equipment comprising such emission unit unless the applicant demonstrates to the satisfaction of the Air Pollution Control Officer (APCO) that such limitations are not achievable.
- Any other emission control device or technique, alternative basic equipment, different fuel or process, determined to be technologically feasible and cost-

effective by the APCO. The cost effective analysis shall be performed in accordance with the methodology specified by the APCO.

- Under no circumstances shall BACT be determined to be less stringent than the emission control required by any applicable provision of District, State, of federal laws or regulations, unless the applicant demonstrates to the satisfaction of the APCO that such limits are not achievable.

### **3.4 Air Quality Impact Analysis**

The Knauf Shasta project must demonstrate the air quality impact of the project with both NAAQS and the CARBAQS. Air Quality Impact Assessments (AQIA) are performed using dispersion modeling techniques in accordance with the EPA's "Guidelines on Air Quality Models."

As part of the AQIA, a determination is made as to whether or not the impacts from the facility emissions are high enough to trigger a requirement for ambient air quality monitoring. The *de minimis* impact level for particulates, over a 24-hour averaging period, is 10 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). If the air quality impact exceeds this value, ambient air quality monitoring would be required to establish baseline air quality data. However, a source may qualify for a waiver from the ambient air quality monitoring requirements if existing monitoring data, representative of the area, is readily available. Ambient air quality monitoring data for particulates, as well as other pollutants, from the Redding, California monitoring station is considered representative for the City of Shasta Lake (Michael Kussow, 1996).

#### **3.4.1 Federal Ambient Air Quality Standards**

The National Ambient Air Quality Standards (NAAQS) were established by the United States Environmental Protection Agency to protect public health and welfare. Federal air quality standards have been set for ozone, CO, nitrogen dioxide ( $\text{NO}_x$ ),  $\text{SO}_2$ , lead (Pb), and particulates ( $\text{PM}_{10}$ ). The federal Clean Air Act provides that NAAQS can be exceeded no more than once each year. Areas that exceed the standard four times in three years or more can be considered "nonattainment areas" subject to more stringent planning and pollution control requirements. The NAAQS values are presented in Table 3.1-3.

#### **3.4.2 State Ambient Air Quality Standards**

The State of California has established its own ambient air quality standards, to protect public health and welfare and to prevent the significant deterioration of air quality. They are administered by the California Air Resources Board (CARB). The state has set its own standards for all NAAQS standards, as well as for hydrogen sulfide and vinyl chloride. The CARBAQS



that have been established are more restrictive than the accompanying federal standards. The CARBAQS values are also presented in Table 3.1-3.

Both state and federal air quality standards consist of two parts: an allowable concentration of a pollutant and an averaging time over which the concentration is to be measured. Allowable concentrations are based on the results of research studies of how pollutants affect human health, crops, and vegetation; potential damage to paint and other materials is also considered. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposures to a high concentration for a short period of time (e.g. one hour), or to a relatively lower average concentration over a much longer period (e.g. one year). For certain pollutants, there may be several air quality standards reflecting both short- and long-term effects.

### **3.4.3 Shasta County Standards**

Shasta County currently meets all of the NAAQS federal standards. However, the County is non-attainment for the state standards for PM<sub>10</sub> and ozone, meaning that there has been at least one violation of the state standard for these pollutants in Shasta County.

In addition to the Shasta County monitoring stations located in Redding and Anderson, a special purpose PM<sub>10</sub> ambient air quality monitoring station has been operating near the Knauf facility since January 2001. According to data collected at this site, the state standard has been violated once over the two-year monitoring period. This violation can be attributed to forest fires in Northern California and Oregon during the summer of 2002. With the exception of the one violation, monitored PM<sub>10</sub> levels have remained below the state standard.

During the summer of 2000, the District participated in a statewide ozone study, which included the monitoring of oxides of nitrogen (NO<sub>x</sub>) concentration in Shasta County. The monitoring station was located less than ten miles from the Knauf facility in the town of Bella Vista. Data from this study indicates that state and federal NO<sub>x</sub> standards are not being violated.

A summary of the Shasta County ambient pollutant concentrations (background levels) compared to their CARBAQS values is shown in Table 3.4-1.



**Table 3.4-1. Shasta County Local Ambient Air Quality Levels.**

<b>Pollutant</b>	<b>Averaging Period</b>	<b>CARB Ambient Air Quality Standards (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Shasta County Background Levels (<math>\mu\text{g}/\text{m}^3</math>)<sup>5,6,7,8</sup></b>
PM <sub>10</sub>	Annual	20	13.7
	24-Hour	50	37.4
NO <sub>x</sub>	Annual		1.5
	1-Hour	470	92.0

The Part 300 requirements of the Air Quality Management District, Rules and Regulations, requires the use of BACT for any new emission unit for any pollutant that exceeds the values in Table 3.4-2.

**Table 3.4-2. Part 300 BACT Thresholds.**

<b>Pollutant</b>	<b>lb/day</b>	<b>TPY</b>
Reactive organic gases	25.0	4.56
Nitrogen oxides	25.0	4.56
Sulfur oxides	80.0	14.6
PM <sub>10</sub>	80.0	14.6
Carbon monoxide	500.0	91.25

### **3.5 Good Engineering Practice Stack Height**

The EPA has established a Good Engineering Practice (GEP) stack height policy that limits the use of dispersion enhancement due to extremely tall stacks. The regulation does not limit the physical stack height, but rather limits the height of a stack that can be used in the dispersion modeling study. GEP stack height is defined as 65 meters (213 feet), or  $(H + 1.5L)$ , where H is building height and L is the lesser dimension of the height or projected width of the building.

<sup>5</sup> PM<sub>10</sub> ambient air quality data from City of Shasta Lake Animal Shelter monitoring station, data taken from 1/1/2001 to 2/14/2003

<sup>6</sup> 24 hour PM<sub>10</sub> background concentration listed is second high over monitoring period due to maximum being caused by forest fires in California and Oregon during the summer of 2002 (56.3  $\mu\text{g}/\text{m}^3$ )

<sup>7</sup> NO<sub>x</sub> ambient air quality data from Bella Vista, CA Ozone Study performed by CARB in 2000

<sup>8</sup> Value provided for annual NO<sub>x</sub> background concentration is average value from 45 day sampling period

For example, if the building height (H) is 50 feet, and the projected width is 200 feet, then L is 50 feet and the GEP height is  $(50 + 1.5 \times 50)$ , or 125 feet. Therefore, the GEP height is calculated to be 125 feet, but a stack height up to 213 feet (65 meters) can be built and the entire height will be allowed for modeling purposes.

Another example for a GEP height above 213 feet is as follows. If the GEP stack height is determined to be 220 feet, one can still build a stack that is 300 feet tall but the mathematical modeling of the plant can only take credit for a physical stack height of 220 feet.

A stack height shorter than GEP is allowable by the regulations, but the AQIA modeling study must consider the aerodynamic downwash effects of structures on the dispersion of air pollutants (discussed later).

### **3.6 Hazardous Air Pollutants**

A major emission source for hazardous air pollutants (HAP) is defined as a source that emits more than 10 TPY of any one of the listed HAPs, or an aggregate to HAPs that exceeds 25 TPY. The Knauf Fiber Glass facility is a major HAP emission source and is subject to the applicable Maximum Achievable Control Technology (MACT) standards. The National Emission Standard for Hazardous Air Pollutants (NESHAP) for Wool Fiberglass Manufacturing was promulgated on June 14, 1999. This rule established a PM limit (a surrogate for arsenic, chromium, and lead) of 0.5 lb/ton of glass pulled from the glass furnace. The NESHAP also established a formaldehyde emission limit (a surrogate for phenol and methanol) of 0.8 lb/ton of glass pulled for new rotary spin manufacturing lines.

Sources of hazardous air pollutants are also evaluated at the state level. The State of California has set 8-hour permissible exposure levels (PEL) for a number of hazardous air pollutants. The PEL values for formaldehyde, phenol, and ammonia are given in Table 3.1-3.

In addition to the comparison to PEL values, CARB developed regulations for Assembly Bill (AB) 2588, the Air Toxics Hot Spots Information and Assessment Act of 1987. Facilities that exceed certain thresholds for hazardous air pollutant emissions are subject to AB 2588 requirements. AB 2588 requires facilities to report their emissions of toxic air contaminants. Facilities are subsequently prioritized by their emissions, and "high priority" facilities are required to conduct a health risk assessment.

The Knauf facility emits phenol, formaldehyde, and ammonia at levels which require evaluation under AB 2588. An evaluation of the air toxics emission rates will be completed in August, 2003. This study will evaluate human health risks calculated with health risk factors provided by the California Air Pollution Control Officers Association (CAPCOA, 1993). The risk factors were developed based on available data on human and animal exposure. Safety factors have been incorporated into the risk factors to protect human health.



Incremental cancer risk represents a person's increased chance of contracting cancer after living at the point of maximum concentration continuously for 70 years. The incremental cancer risk level considered to be significant by Shasta County is  $1 \times 10^{-5}$ , or 1 in 100,000.

A chronic hazard index is a ratio of the toxic air contaminant's concentration at the level at which noncarcinogenic health effects may occur after long-term exposure. A hazard index greater than 1.0 indicates that adverse health effects could occur. The evaluation is performed using the maximum five-year average pollutant concentrations predicted by dispersion modeling.

An acute hazard index is a ratio of a toxic air contaminant's concentration to the level at which noncarcinogenic health effects may occur after short-term exposure. Once again, a hazard index greater than 1.0 indicates that adverse health effects could occur. The evaluation is performed using the maximum one-hour average pollutant concentrations predicted by dispersion modeling.

### **3.7 Soils and Vegetation**

The PSD program requires an evaluation of the project's air pollution impacts on soil and vegetation. After the completion of air quality modeling, an assessment of the impacts of pollution in the project area can be performed by correlating the modeling results with established "harmful effects" levels. For most types of soils and vegetation, air quality impacts below the NAAQS will not result in harmful effects. A soil and vegetation analysis is presented in Section 9.

### **3.8 Class I Area Impact Analysis**

PSD increments have also been established for air quality in federal Class I areas. These levels are more stringent than the normal NAAQS presented in Table 3.2-1. For  $PM_{10}$ , the Class I increment is  $4 \mu\text{g}/\text{m}^3$  for annual averages, and  $8 \mu\text{g}/\text{m}^3$  for 24-hour averages. For  $NO_x$ , the Class I increment is  $2.5 \mu\text{g}/\text{m}^3$  for an annual average, never to be exceeded. A Class I area impact analysis is addressed in Section 10.

For PSD sources, an applicant is also required to demonstrate that the emissions from the source(s) will not cause or contribute to adverse impacts to Air Quality Related Values (AQRV) in any Class I area. The study evaluates the potential for impacts on sensitive receptors in the Class I areas, and needs to demonstrate that the acceptable limits of air pollution-caused changes (LAC) are not exceeded. The guidelines that are followed for Class I impact studies include the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I report from December, 2000, the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts, issued in December, 1998, and 40 CFR 51, Revision of the Guideline on Air Quality Models: Adoption of



a Preferred Long Range Transport Model and Other Revisions; Final Rule, published April 15, 2003.

### **3.9 Visibility**

An analysis of visibility impairment is required at Class I land use areas as part of the PSD permitting process. Class I areas are national park and wilderness areas with more stringent air quality standards. EPA regulations define visibility impairment as any humanly perceptible change in visibility (visual range, contrast, or coloration) from natural conditions. To determine if a source will impair visibility at a federal Class I area, the EPA and Federal Land Managers require the use of the EPA's CALPUFF model to demonstrate that its emissions will not impair visibility inside any Class I area. A visibility analysis for the Knauf Shasta facility is addressed in Section 10.

### **3.10 Direct Growth Analysis**

The PSD program requires an analysis of the anticipated growth in an area and subsequent air quality impacts associated with growth as a direct result of the project. Since this evaluation was covered in detail in the Environmental Impact Report for the Knauf Fiber Glass plant as part of the CEQA process, Knauf hereby incorporates the EIR growth analysis by reference.

### **3.11 Endangered Species Evaluation**

Under Section 7 of the Endangered Species Act, impacts of a PSD project on endangered and threatened species and their habitats must be adequately assessed. Since this evaluation was covered in detail in the Environmental Impact Report for the Knauf Fiber Glass plant as part of the CEQA process, Knauf hereby incorporates the EIR endangered species analysis by reference.

## 4.0 EMISSION STANDARDS

The Knauf facility must demonstrate compliance with the applicable NSPS Subpart PPP for fiber glass manufacturing. The controlled particulate emissions from the rotary spin wool fiber glass operation, including the condensable organics, will be 21.6 lb/hr for a production rate of 195 ton/day. This equates to 2.7 lb/ton for manufacturing and easily complies with the 11 lb/ton NSPS limit. Since the electric glass melting furnace is exempt from the NSPS in 40 CFR 60, Subpart CC (no fuel combustion), only 40 CFR 60, Subpart PPP is applicable.

The MACT standard for glass melting (see Section 3.6) is 0.5 lb PM per ton of glass pulled. Although the MACT standard allows 4.1 lb/hr, the Knauf PSD/ATC permit limit will be 1.0 lb/hr at 195 tons of glass pulled per day, which equates to 0.123 lb/ton of glass pulled.

The MACT standard for new rotary spin fiberglass manufacturing lines is 0.8 lb of formaldehyde per ton of glass pulled. Although the MACT standard allows 6.5 lb/hr, the Knauf PSD ATC permit limit is 2.0 lb/hr at 195 tons per day, which equates to 0.25 lb/ton of glass pulled.

## 5.0 BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

Based on the potential to emit emission rates for the Knauf facility shown in Table 3.1-2, and the Part 300 BACT thresholds of Table 3.5-1, the following pollutants would require a BACT analysis:

- PM<sub>10</sub>
- Nitrogen oxides
- Carbon monoxide
- Reactive organic gases

No further evaluation has been prepared for PM<sub>10</sub> since the emission rates for PM<sub>10</sub> have decreased from the original PSD permit approval. Likewise, no further BACT analysis has been prepared for carbon monoxide and reactive organic gases because emission limits have not changed.

The only air pollutant to increase is NO<sub>x</sub> from the manufacturing line, and therefore, this BACT analysis covers an update for NO<sub>x</sub> emissions from the manufacturing line.

### 5.1 BACT Analysis – Manufacturing Line NO<sub>x</sub>

Emissions from the manufacturing line at the Knauf Shasta facility consist of condensed and uncondensed PM<sub>10</sub>, as well as reactive organic gases (ROG) from the binder. The combustion of natural gas in the forming fiberizers and the low NO<sub>x</sub> oven burners results in emissions of NO<sub>x</sub>, SO<sub>2</sub>, CO, ROG, and trace amounts of PM<sub>10</sub>.

The facility has been constructed with thermal oxidizers to control emissions of ROG and condensable particulates from the curing oven. Thermal oxidizers are very effective at the reduction of ROG. However, as discussed in Section 2.1.4, the combustion of natural gas in the eight (8) oven burners and two (2) thermal oxidizer burners results in NO<sub>x</sub> emissions. These emissions are minimized through the use of low NO<sub>x</sub> burners. Unfortunately, the thermal curing of binder results in a release of ammonia (see Figure 2.1-3). A portion of this ammonia is converted to NO<sub>x</sub> as it passes through the thermal oxidizers and greater than 50% of the NO<sub>x</sub> emitted is associated with this process.

Virtually all NO<sub>x</sub> emissions produced by natural gas combustion originates as NO. This NO is further oxidized in the exhaust system or later in the atmosphere to form the more stable NO<sub>2</sub> molecule. There are two mechanisms by which NO<sub>x</sub> can be formed in the high temperature region (>2,500 °F) in and around the burner flame: 1) the oxidation of atmospheric nitrogen found in the combustion air (thermal NO<sub>x</sub> and prompt NO<sub>x</sub>), and 2) the conversion of nitrogen chemically bound in the fuel (fuel NO<sub>x</sub>). These mechanisms are discussed in the following paragraphs.



Thermal NO<sub>x</sub> is formed by a series of chemical reactions in which oxygen and nitrogen present in the combustion air dissociate and subsequently react to form oxides of nitrogen. The major contributing chemical reactions are known as the Zeldovich mechanism. Simply stated, the Zeldovich mechanism postulates that thermal NO<sub>x</sub> formation increases exponentially with increases in temperature and linearly with increases in residence time. Flame temperature is dependent on the air/fuel ratio. A stoichiometric ratio is the point at which a flame burns at its highest theoretical temperature.

Prompt NO<sub>x</sub>, a form of thermal NO<sub>x</sub>, is formed in the proximity of the flame front as intermediate combustion products, such as HCN, N, and NH, are oxidized to form NO<sub>x</sub>. Prompt NO<sub>x</sub> is formed in both fuel rich flame zones and in fuel-lean combustion zones typical of some low-NO<sub>x</sub> burner designs. The contribution of prompt NO<sub>x</sub> to overall NO<sub>x</sub> emissions is relatively small in conventional burners. This contribution is an increasingly significant percentage of overall thermal NO<sub>x</sub> emissions in low-NO<sub>x</sub> burners.

Fuel NO<sub>x</sub> is formed when fuels containing nitrogen are burned. Molecular nitrogen, present as N<sub>2</sub> in some natural gas and propane, does not contribute significantly to fuel NO<sub>x</sub> formation. The nitrogen content of liquid and solid hydrocarbon fuels, such as diesel oil and coal, can range from 0.1 to 2.0 percent by weight. When these fuels are burned, the nitrogen bonds break and some of the resulting free nitrogen oxidizes to form NO<sub>x</sub>. With excess air, the degree of fuel NO<sub>x</sub> formation is primarily a function of the nitrogen content in the fuel. The fraction of fuel-bound nitrogen (FBN) converted to fuel NO<sub>x</sub> decreases with increasing nitrogen content, although the absolute magnitude of fuel NO<sub>x</sub> increases. For example, a fuel with 0.01 percent nitrogen may have 100 percent of its FBN converted to fuel NO<sub>x</sub>, whereas a fuel with a 1.0 percent FBN may have only 40 percent conversion rate. Natural gas contains essentially no FBN. As a result, when compared to thermal NO<sub>x</sub>, fuel NO<sub>x</sub> is not a significant contributor to overall NO<sub>x</sub> emissions from curing oven burners.

Two potential post combustion NO<sub>x</sub> control technologies include Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR).

SCR involves the injection of ammonia into an exhaust gas stream at a temperature range of 600 to 900 °F that then passes through a precious metal or zeolite catalyst bed. The two primary NO<sub>x</sub> reduction reactions, in the presence of a catalyst, are:



The fact that the thermal oxidizer generates most of the NO<sub>x</sub>, plus the fact that the temperature exiting the thermal oxidizer is 1400 °F, makes an SCR a technically infeasible option for control.

SNCR involves the injection of ammonia or urea into an exhaust gas stream of approximately 1600 °F to 2000 °F temperature range. SNCR works most efficiently with elevated NO<sub>x</sub> levels and a relatively long residence time of 1 to 2 seconds. Ammonia usage is greater than with SCR-based systems to achieve similar reductions. The low NO<sub>x</sub> levels plus the 500 °F gas stream temperature upstream of the thermal oxidizers, and 1400 °F temperature leaving the thermal oxidizers, makes SNCR technically infeasible for the Knauf curing oven/thermal oxidizer exhaust.

Table 5.1-1 lists manufacturing line NO<sub>x</sub> emission rates from other comparable new wool fiberglass manufacturing facilities in the United States. The Knauf Shasta NO<sub>x</sub> level is the lowest comparable emission rate (lb/ton) of any wool fiberglass manufacturing plant equipped with thermal oxidizers, and is roughly one-third the level of the most recent PSD Permit level issued to the Johns-Mansville Plant in Winder, Georgia (1999). It should be noted that SCR and/or SNCR systems have never been utilized at any wool fiberglass manufacturing facility. The use of thermal oxidizers at the Knauf Shasta facility has the additional benefit of being extremely efficient at controlling condensable particulate matter and reactive organic gases.

**Table 5.1-1 NO<sub>x</sub> Control Technology for Wool Fiberglass Manufacturing Line.**

<b>Company/Location</b>	<b>Manufacturing Line NO<sub>x</sub> Control Technology</b>	<b>NO<sub>x</sub> Emission Limit</b>	<b>Comments</b>
Knauf, Shasta Lake, CA	Low NO <sub>x</sub> Burners (on oven & thermal oxidizers)	2.79 lb/ton of glass pulled (22.6 lb/hr, 99 tons/year)	Application for Air Permit Modification
Johns-Mansville, Winder, GA	Good combustion control	6.05 lb/ton of glass pulled	PSD Application and Title V Permit
Certainteed, Kansas City, KS <sup>1</sup>	Good combustion control (no thermal oxidizer on oven exhaust)	1 lb/ton of glass pulled	No RTO, higher VOC limits

The Knauf Shasta facility concludes that the only feasible NO<sub>x</sub> control option for the manufacturing line is the use of low NO<sub>x</sub> burners to minimize the formation of NO<sub>x</sub> during the combustion stage. BACT is considered to be the use of low NO<sub>x</sub> burners. The benefits of the use of thermal oxidizers for control of organic emissions and condensable particulates outweigh the increased NO<sub>x</sub> emissions resulting from the conversion of ammonia to NO<sub>x</sub> as it passes through the thermal oxidizers.



## 6.0 AIR QUALITY IMPACT ANALYSIS

An AQIA was performed to verify compliance with air quality standards. The primary objective of this analysis was to determine the worst-case ground-level impacts for comparison with the established air quality standards and other regulatory thresholds. If standards and thresholds are not exceeded under these worst-case conditions, then no exceedances are expected under any conditions.

### 6.1 Modeling Methodology

Impacts on ambient air quality from the Knauf facility were assessed using the ISC PRIME (Industrial Source Complex Plume RIse Model Enhancements) air quality dispersion model. This model includes COMPLEX I modeling capability for complex terrain and the PRIME algorithm for aerodynamic downwash determination. The ISC PRIME model is a versatile Gaussian dispersion model developed by EPA that is capable of assessing impacts from a variety of separate sources in regions of simple or complex terrain. The model is designed to evaluate a wide variety of sources within an industrial source complex. The ISC PRIME model can account for settling and dry deposition of particulates; area, line, and volume sources; plume rise as a function of downward distance; separation of point sources; and elevated receptors. The model is capable of estimating concentrations for a wide range of averaging times from one hour to one year. The ISC PRIME model also evaluates the impacts of multiple sources and sources over distances up to 31.25 miles (50 kilometers).

### 6.2 Emissions and Stack Parameters

The stack dimensions and exit parameters presented in Table 6.2-1 compare the originally submitted PSD model input parameters with revised input parameters.

**Table 6.2-1 Stack Exit Parameters.**

Parameter	Original PSD Modeling		Revised Modeling <sup>1</sup>	
	Forming Stack	Electric Furnace Dust Collector	Forming Stack	Electric Furnace Dust Collector
Stack Height, ft	200	85	199	85
Exit Temperature, deg F	190	175	137.7	115.3
Exit Diameter, ft	17	1.74	17	3.08
Flow Rate, ACFM	447,531	9,885	403,828	24,447
Exit Velocity, fps	32.9	69.29	29.7	54.7

1. Revised exit parameters based on worst case emission test data



A comparison of originally proposed PSD emission limits and revised emission limits proposed with this submittal are given in Table 6.2-2.

**Table 6.2-2 Emission Rates for ISC PRIME Modeling.**

Pollutant	Originally Proposed PSD Limits		Revised Emission Limits	
	Forming Stack	Electric Furnace Dust Collectors	Forming Stack	Electric Furnace Dust Collectors
PM <sub>10</sub> (lb/hr)	43.6	0.1	21.9	1.0
PM <sub>10</sub> (ton/yr)	191.0	0.4	95.6	4.4
NO <sub>x</sub> (lb/hr)	5.7		22.6	
NO <sub>x</sub> (ton/yr)	24.8		99	

## 6.3 Meteorology and Terrain Data

### 6.3.1 Meteorological Data

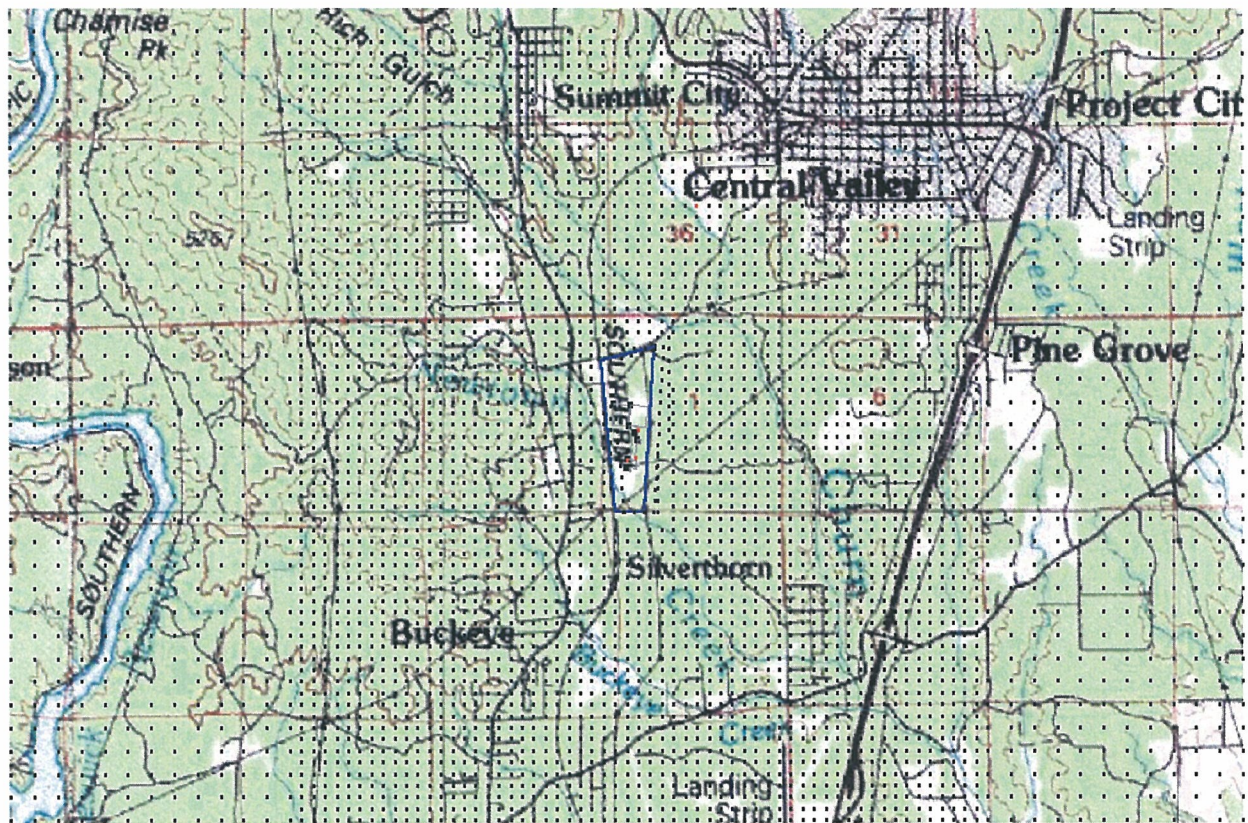
Meteorological data for the modeling was based on five (5) years of hourly surface data from the Redding airport, from 1987-1991. Concurrent upper air mixing height data was obtained from the nearest available source in Medford, Oregon. Data from Redding and Medford were used in this analysis because, when compared with other meteorological stations providing data in compatible formats, they provide the most representative meteorological data for the Knauf facility location. The data was pre-processed for input into the ISC PRIME dispersion model. A summary of the meteorological data for the five years can be found in Appendix B.

### 6.3.2 Terrain

The terrain surrounding the Knauf Shasta site is considered complex, which is characterized by terrain features above the effective stack height of the forming stack. Since complex terrain modeling was required, digitized terrain in 30-meter increments out to 48 kilometers in each direction from the plant was obtained from the United States Geological Survey.

## 6.4 Receptor Grids

The Knauf facility was modeled out to 2.6 kilometers in each direction with a 100-meter rectangular grid, to 5 kilometers in each direction with a 200-meter grid, to 10 kilometers in each direction with a 500-meter grid, and 45 kilometers in each direction with a 5000-meter grid. A diagram of the receptor grid near Knauf can be found in Figure 6.4-1.



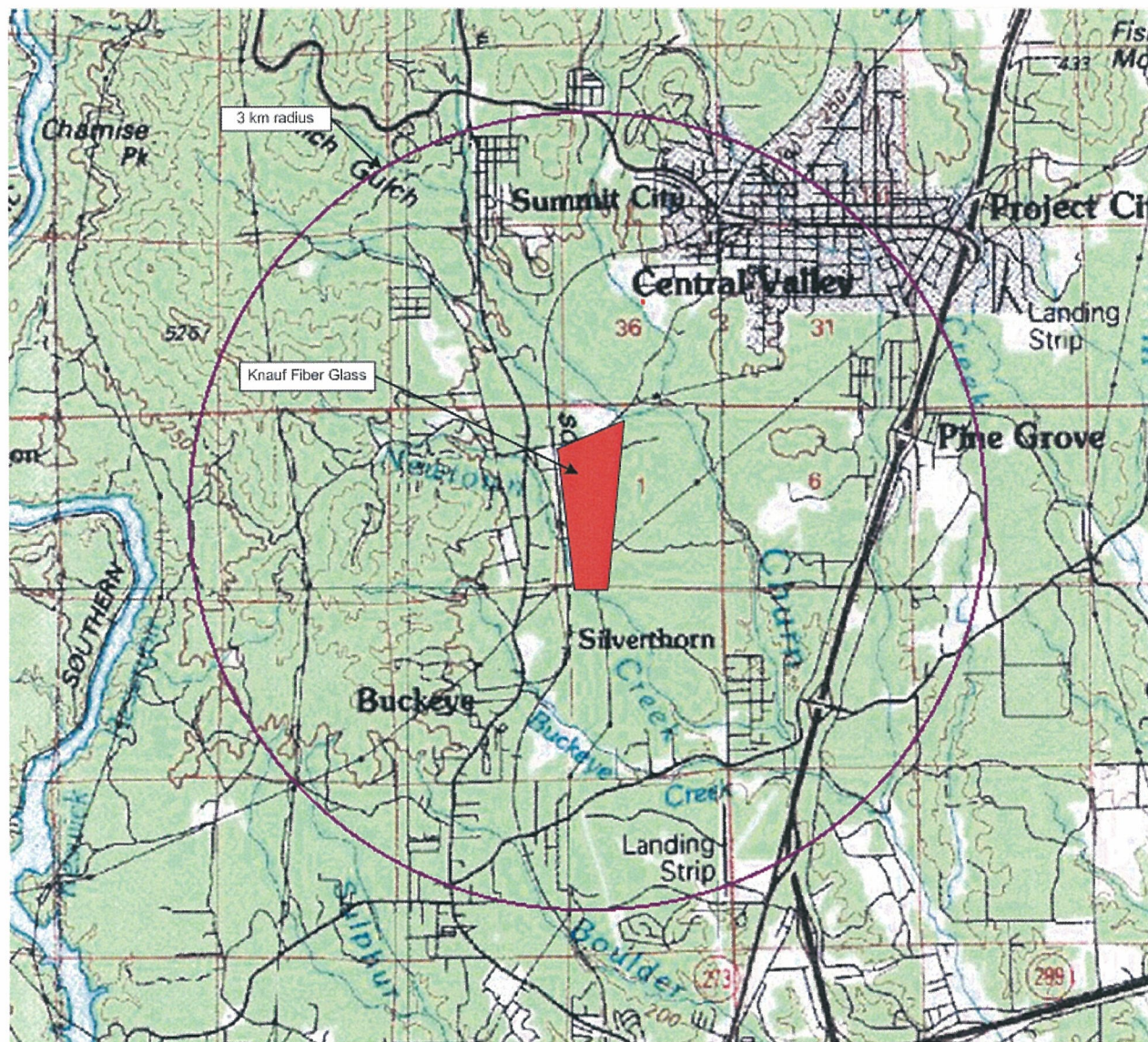
**Figure 6.4-1. Modeled Receptor Grid Near Knauf Fiber Glass.**

## **6.5 Rural/Urban Determination**

A technique was developed by Irwin (1979) to classify a site area as either rural or urban for purposes of using rural or urban dispersion coefficients. The classification can be based on either land use or population density within 3 kilometers of an emission source. Of these, the USEPA has specified that land use is the most definitive criterion (USEPA, 1993b).

Using the meteorological land use typing scheme established by Auer (1978) for an area within a 3 kilometer radius from a site, an urban classification of the site area requires more than 50 percent of the following land use types: heavy industrial, light-moderate industrial, commercial, single family compact residential, and multi-family compact residential. Since rural land use types comprise greater than 70% of the total area in the vicinity of the Knauf facility, rural dispersion coefficients were employed in the model to calculate plume dispersion (see Figure 6.5-1).





**Figure 6.5-1. Topographical Map of Area Near the Knauf Fiber Glass Site.**

## 6.6 Modeling Analysis

A modeling analysis was performed at 1 hour and annual intervals for  $\text{NO}_x$ . An analysis for  $\text{PM}_{10}$ ,  $\text{SO}_2$ ,  $\text{CO}$ , Phenol, Formaldehyde, ROG and Ammonia was performed for the original PSD permit application submittal and will not be repeated here since the emissions of these pollutants remain unchanged, or are reduced. Table 6.6-1 presents a summary of the modeling results, with a complete listing in Appendix C. Also included in Appendix C is a CD-ROM containing all modeling input and output files. Concentration distribution isopleths for  $\text{NO}_x$  can be found in Appendix D.



**Table 6.6-1. Air Quality Modeling Results.**

Pollutant	Averaging Period	Maximum Concentration – Original PSD Proposed Limits ( $\mu\text{g}/\text{m}^3$ )	Maximum Concentration - Revised Limits ( $\mu\text{g}/\text{m}^3$ )	PSD Increment ( $\mu\text{g}/\text{m}^3$ )	Significant Impact Levels ( $\mu\text{g}/\text{m}^3$ )
PM <sub>10</sub>	24-Hour	11.3	NA	30	5
	Annual	0.62	NA	17	1
NO <sub>x</sub>	1-Hour	14.3	71.6	NA	NA
	Annual	0.08	0.45	25	1

#### 6.6.1 Ambient Air Quality Analysis

NO<sub>x</sub> emission impacts are compared with National and CARB Ambient Air Quality Standards even though impacts were below the PSD significance level of 1  $\mu\text{g}/\text{m}^3$ .

Table 6.6-2 summarizes the results of the analysis. The results indicate that the maximum NO<sub>x</sub> impacts from Knauf, when combined with the background ambient air quality, will comply with the National and CARB Ambient Air Quality Standards. In addition, this analysis does not take into account offsets obtained by Knauf for the existing permitted NO<sub>x</sub> emission limit, and does not take into account offsets that will be obtained for the increase in NO<sub>x</sub> requested in this permit application.

**Table 6.6-2. Ambient Air Quality Impacts from Knauf.**

Pollutant	Averaging Period	Modeled Maximum for Knauf ( $\mu\text{g}/\text{m}^3$ )	Maximum Background Ambient Air Quality <sup>1,2</sup> ( $\mu\text{g}/\text{m}^3$ )	Combined Total Impact ( $\mu\text{g}/\text{m}^3$ )	NAAQS ( $\mu\text{g}/\text{m}^3$ )	CARBAQS ( $\mu\text{g}/\text{m}^3$ )
NO <sub>x</sub>	1-Hour	71.6	92.0	163.6	NA	500
	Annual	0.45	1.5	2.0	100	NA

1. NO<sub>x</sub> ambient air quality data from Bella Vista, CA Ozone Study performed by CARB in 2000

2. Value provided for annual NO<sub>x</sub> background concentration is average value from 45 day sampling period

#### 6.6.2 Increment Analysis

The PSD regulations establish the term “increment” which is the maximum allowable increase in concentration that is allowed to occur for a pollutant. The “baseline” concentration is defined for each pollutant and averaging time as the ambient concentration existing at the time that the first

PSD permit application affecting the area is submitted. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable PSD increment.

Several dates are important. The “major source baseline date” is the date after which actual emissions associated with the construction at the source affect the available PSD increment. Other changes in actual emissions occurring at any source after the major source baseline date do not affect the increment, but instead (until the minor source baseline date is established) contribute to the baseline concentration.

The “trigger date” is the date after which the minor source baseline date may be established. The “minor source baseline date” is the earliest date after the trigger date on which a complete PSD application is received and accepted by the permit-reviewing agency. This date marks the point in time after which all sources affect the available increment. The area in which the minor source baseline date is established the permit application is known as the “baseline area,” which includes all portions of the attainment (or unclassifiable area) in which the PSD applicant proposes to locate and any attainment (or unclassifiable area) in which the proposed emissions would have a significant ambient impact (defined at  $> 1 \mu\text{g}/\text{m}^3$  for an annual average).

On December 19, 1996, Knauf representatives met with Messrs. Michael Kussow and Ken Berryman of the Shasta County Air Pollution Control District to discuss the Air Permit Application. At the meeting, it was learned that (1) no other PSD project has located in the Shasta Lake “baseline area” for the Knauf site, (2) the only significant emission source near the Knauf facility was the Sierra Pacific mill, and (3) the full PSD increment was still available for the Knauf project. Therefore, the minor source baseline date was established on the date that the Knauf permit application was deemed complete by Shasta County.

For  $\text{NO}_x$  emissions, the PSD increment is  $25 \mu\text{g}/\text{m}^3$  with a  $1\text{-}\mu\text{g}/\text{m}^3$  significant impact level. Since the maximum annual  $\text{NO}_x$  impact was only  $0.45 \mu\text{g}/\text{m}^3$ , no increment analysis is required.

## **6.7 Emissions Offsets**

### **6.7.1 Particulates**

The Knauf facility has obtained  $\text{PM}_{10}$  emission offsets at a ratio of 1.2 to 1 for emissions above 25 TPY. This equates to  $1.2 \times (124.4 - 25)$ , or 119.3 TPY. The offsets are from road paving and purchasing of existing emission credits.

### **6.7.2. $\text{NO}_x$**

The Knauf facility has obtained  $\text{NO}_x$  emission offsets at a ratio of 1.0 to 1 for  $\text{NO}_x$  emissions over 4.6 TPY, up to the proposed permit limit of 99 TPY. All such offset credits were certified through the Shasta County Air Quality Management District.

## **7.0 GOOD ENGINEERING PRACTICE STACK HEIGHT**

A Good Engineering Practice (GEP) stack height determination was made for the proposed furnace/forming exhaust stack. GEP stacks reduce the effects of building downwash, a condition which can lead to increased air pollution concentrations at ground level. GEP stack heights are also used by EPA as an “upper limit” stack height for the purposes of modeling ground level pollutant concentrations from proposed sources.

Given the dimensions of the Knauf Shasta buildings, with a maximum building height of 78 feet, plus a batch house height of 125 feet, the GEP stack height to avoid downwash effects in all directions is 310.2 feet. The stack height of 199 feet has been kept lower than the GEP height to minimize the visual impact of the facility. By staying below 200 feet, no stack lighting was needed in accordance with Federal Aviation Administration (FAA) requirements.

Since non-GEP stack heights were evaluated, the ISCST3 model was run with the option to evaluate the effects of aerodynamic downwash. The direction specific downwash option of the model was used for the modeling studies.



## 8.0 HAZARDOUS AIR POLLUTANTS

### 8.1 Permissible Exposure Limits

The State of California has set 8-hour permissible exposure limits (PELs) for a number of Hazardous Air Pollutants (HAPs), including Ammonia, Formaldehyde and Phenol. The results of this evaluation from the original PSD application are repeated here for information only.

Ammonia emissions from the Knauf facility are a maximum of 38 lbs/hr. At this emission rate, the maximum-modeled ammonia concentration was  $34.55 \mu\text{g}/\text{m}^3$ . Since the calculated ammonia concentration is significantly less than the 8-Hour PEL of  $18,000 \mu\text{g}/\text{m}^3$ , no further modeling was required.

Formaldehyde emissions from the Knauf facility are a maximum of 2 lbs/hr. At this emission rate, the maximum-modeled formaldehyde concentration was  $1.82 \mu\text{g}/\text{m}^3$ . Since the calculated concentration is significantly less than the 8-Hour PEL of  $2,000 \mu\text{g}/\text{m}^3$ , no further modeling was required.

Phenol emissions from the Knauf facility are a maximum of 6 lbs/hr. At this emission rate, the maximum-modeled phenol concentration was  $5.46 \mu\text{g}/\text{m}^3$ . Since the calculated concentration is significantly less than the 8-Hour PEL of  $19,000 \mu\text{g}/\text{m}^3$ , no further modeling was required.

The modeling results for the Hazardous Air Pollutants emitted from the Knauf facility along with their 8-hour PEL limits are presented in Table 8.1-1.

**Table 8.1-1. Hazardous Air Pollutant Concentrations 200' Stack.**

Pollutant	Concentration ( $\mu\text{g}/\text{m}^3$ )	8-Hour PEL ( $\mu\text{g}/\text{m}^3$ )
Ammonia	34.55	18,000
Formaldehyde	1.82	2,000
Phenol	5.46	19,000

### 8.2 Hazard Risk Analysis

To assess the significance of the project's hazardous air pollutant emissions, dispersion modeling was conducted to predict the maximum 1-hour and 5-year average concentrations in the project vicinity. Incremental human health risks were calculated using health risk factors provided by the California Air Pollution Control Officers Association (CAPCOA), as discussed in Section 3.7.

A summary of the maximum predicted HAP concentrations from the original PSD permit is presented here for information only. This summary reflects levels that may occur during plant operation is given in Table 8.2-1. The results demonstrate that, in accordance with the CAPCOA health risk factors and assessment procedures, the Knauf Shasta HAP emissions are insignificant, and do not result in any adverse health effects.

### 8.2.1 Phenol

Based on the Air Toxics “Hot Spots” Program Risk Assessment Guidelines, there is no Unit Risk Factor for phenol. The chronic noncancer Reference Exposure Level (REL) is  $45.0 \mu\text{g}/\text{m}^3$ , and there is no acute noncancer REL.

A hazard index greater than 1.0 indicates a potential for adverse health effects. The chronic hazard index for phenol is calculated by dividing the chemical’s 5-year average concentration by the REL.

#### *200’ Stack*

$$\text{Phenol Chronic Hazard Index} = 0.07 \mu\text{g}/\text{m}^3 / 45.0 \mu\text{g}/\text{m}^3 = \mathbf{0.00156}$$

### 8.2.2 Formaldehyde

The cancer unit risk factor for formaldehyde is  $6.0\text{E-}6 (\mu\text{g}/\text{m}^3)^{-1}$ . (Risks associated with different chemicals are additive.) To calculate the cancer risk, the 5-year average concentration predicted by modeling is multiplied by the unit risk factor.

#### *200’ Stack*

$$\text{Formaldehyde Risk Factor} = 0.02 \mu\text{g}/\text{m}^3 * 6.0\text{E-}6 (\mu\text{g}/\text{m}^3)^{-1} = \mathbf{0.00000012}$$

The chronic noncancer REL is  $3.6 \mu\text{g}/\text{m}^3$ , and the acute noncancer REL is  $370 \mu\text{g}/\text{m}^3$ . The chronic hazard index for formaldehyde is calculated by dividing the chemical’s 5-year average concentration by the REL. The acute hazard index for formaldehyde is calculated by dividing the chemical’s maximum 1-hour average concentration by the REL.

#### *200’ Stack*

$$\text{Formaldehyde Chronic Hazard Index} = 0.02 \mu\text{g}/\text{m}^3 / 3.6 \mu\text{g}/\text{m}^3 = \mathbf{0.00556}$$

$$\text{Formaldehyde Acute Hazard Index} = 5.05 \mu\text{g}/\text{m}^3 / 370.0 \mu\text{g}/\text{m}^3 = \mathbf{0.01365}$$

### 8.2.3 Ammonia

There is no cancer unit risk factor for ammonia. The chronic noncancer (REL) is  $100.0 \mu\text{g}/\text{m}^3$ , and the acute noncancer REL is  $2,100 \mu\text{g}/\text{m}^3$ . The chronic hazard index for ammonia is calculated by dividing the chemical’s 5-year average concentration by the REL. The acute hazard index for ammonia is calculated by dividing the chemical’s maximum 1-hour average concentration by the REL.

#### *200’ Stack*

$$\text{Ammonia Chronic Hazard Index} = 0.44 \mu\text{g}/\text{m}^3 / 100.0 \mu\text{g}/\text{m}^3 = \mathbf{0.0044}$$

$$\text{Ammonia Acute Hazard Index} = 96.00 \mu\text{g}/\text{m}^3 / 2,100.0 \mu\text{g}/\text{m}^3 = \mathbf{0.04571}$$

**Table 8.2-1. Summary of Hazardous Air Pollutant Impacts 200' Stack**

<b>Pollutant</b>	<b>5-Year Average (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Maximum 1-Hour (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Incremental Lifetime Cancer Risk</b>	<b>Chronic Hazard Index</b>	<b>Acute Hazard Index</b>
Phenol	0.07	15.16	-	0.00156	-
Formaldehyde	0.02	5.05	0.00000012	0.00556	0.01365
Ammonia	0.44	96.00	-	0.0044	0.04571
Total			0.00000012		
Significance Criteria			0.00001	> 1.0	> 1.0



## 9.0 SOILS AND VEGETATION

With the plant in operation, air emissions from the facility will have no impact on soils and vegetation in the area. The Knauf facility combusts only natural gas which is extremely low in sulfur. Therefore, there are insignificant amounts of “acid rain” precursors commonly found in plumes from oil- and coal-fired emission sources.

The stack emissions from the facility will have no impact on soils and vegetation in the region. As demonstrated by the modeling study, the air quality impacts demonstrate full compliance with the NAAQS levels for all pollutants. The NAAQS levels were established to protect human health and public welfare (including soils and vegetation). By demonstrating that the Knauf facility will not cause violations of the NAAQS, one may conclude that there will be no impact on soils and vegetation.

## **10.0 CLASS I AREA IMPACT ANALYSIS AND VISIBILITY**

PSD regulations require estimation of the impact of criteria pollutants and visibility impairment on any Class I area within 200 kilometers (100 miles) of a major source. A Level II Visibility Impairment study was performed using the EPA VISCREEN Model for the original PSD permit application. The new guidelines require the use of EPA's CALPUFF model for visibility, as well. Long range modeling has been completed using the CALPUFF model. A Class I Area Impact and Visibility Assessment Report was submitted on June 30, 2003.

## 11.0 REFERENCES

1. Air & Waste Management Association, *New Source Review: Prevention of Significant Deterioration and Nonattainment Area Guidance Notebook*, Pittsburgh, 1996.
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5. Trinity Consultants, *Practical Guide to Dispersion Modeling*, Dallas, 1992.
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